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MODEL CURRICULUM GRADE 1

EARTH AND SPACE SCIENCE (ESS)

Topic: Sun, Energy and Weather

This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.

CONTENT STATEMENT

The sun is the principal source of energy.

Sunlight warms Earth's land, air and water. The amount of exposure to sunlight affects the amount of warming or cooling of air, water and land.

CONTENT ELABORATION

Prior Concepts Related to Sun and Weather

PreK-K: Weather changes every day, weather changes are short and long term, the sun is visible during the day and the position of the sun can change.

Grade 1 Concepts

Quantitative measurements must be used to observe and document the warming and cooling of air, water or soil. The length of time an object or material (including water) is exposed to sunlight and its resulting temperature must be observed, as should the amount of time for the object or material to cool down after it is taken out of the sunlight.

Appropriate tools and technology must be used to collect, compare and document data. Investigation and experimentation must be combined with explanation, questioning and discussion of the results and findings.

Future Application of Concepts

Grade 2: The relationship between energy and long- and short-term weather is introduced.

Grades 3-5: Renewable energy, forms of energy (e.g., heat, light, electrical energy), the solar system and patterns/cycles between the Earth and sun are explored.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Make a mini cold frame that can be used to protect plants from cold temperatures. Use recyclable materials, such as plastic bottles, milk jugs or cartons. Evaluate the placement of the cold frame to get the most autumn/ winter sunlight. Compare the results within the class or from class to class. Collect data (temperature, water, outside weather, amount of daily sunlight) to use in the comparison.	Build a model (kit) that can collect or use solar energy (simple, small devices, such as a solar oven, solar wind chimes or solar water heating devices). Ask: *What colors or materials work best? Where does the device work best? What can be done to make the device work better?*	Measure temperature changes of soil, water and air in different settings and/ or exposures to sunlight (e.g., select a grassy area in full sun, in partial sun or in shade and collect temperature readings). Make a graph, chart or table to record the data. Compare/contrast the results in writing or orally.	Recognize that sunlight warms water, air and soil.
	Experiment to compare the length of time it takes to heat samples of water/ soil/air to a specific temperature using sunlight. Discuss findings with the class.		Identify the sun as a primary source of energy.

INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- There are many different ways to measure heating and cooling from sunlight. At the early elementary level, it is important to allow children to explore the causes of temperature changes in materials as it relates to the sun. Background information about **solar heating** and solar energy can help develop research questions to encourage experimentation and investigation.
- Using **water, sun and wind** to explore energy is recommended for early elementary children. While the term and definition of energy is not appropriate for grade 1, exploring, experimentation and observations of energy (e.g., seeing and feeling air and water movement, feeling heat from sunlight) are encouraged.

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COMMON MISCONCEPTIONS

- *Beyond Penguins and Polar Bears* is an online magazine for K-5 teachers. It lists a number of misconceptions held by students regarding the sun and seasons, including that the sun is actually moving across the sky, rather than understanding it is the Earth that is moving. For more information, visit **http://beyondpenguins.nsdl.org/issue/column.php?date=May2008&departmentid=professional&columnid=professional!misconceptions**.
- For examples of misconceptions about the sun and energy, and resources to address misconceptions through investigation, visit **http://amasci.com/miscon/opphys.html**.
- NASA lists common misconceptions for all ages about the sun and the Earth at **http://www-istp.gsfc.nasa.gov/istp/outreach/sunearthmiscons.html**. Providing students with opportunities to experiment and explore the sun and solar energy can be tools to address the misconceptions that may be found at this grade level.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case studies *Patricia–Grade 1* and *Ingrid–Grade 1* are examples of how to develop student-led activities and investigations in science. Students' taking charge and being involved in their learning is essential in teaching science through inquiry.

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MODEL CURRICULUM GRADE 1

EARTH AND SPACE SCIENCE (ESS)

Topic: Sun, Energy and Weather

This topic focuses on the sun as a source of energy and energy changes that occur to land, air and water.

CONTENT STATEMENT

The physical properties of water can change.

These changes occur due to changing energy. Water can change from a liquid to a solid and from a solid to a liquid. Weather observations can be used to examine the property changes of water.

Note: Water as a vapor is not introduced until grade 2; only solid and liquid water should be discussed at this level. A broader coverage of states of matter is found in grade 4. This concept builds on the PS Kindergarten strand pertaining to properties (liquids and solids).

CONTENT ELABORATION

Prior Concepts Related to Water

PreK-K: Water can be observed in many different forms; precipitation (rain, sleet, hail or snow) is a component of weather that can be measured.

Grade 1 Concepts

Water can be observed in lakes, ponds, streams, wetlands, the ocean and through weather events. Freezing and melting of water are investigated through measurements and observations using technology, in the classroom or in a natural setting. Examining maps (virtual or 2-D) of Ohio, world maps or globes can illustrate the amount of Earth's surface that is covered in water and why it is important to learn about water. Water can change the shape of the land (e.g. moving soil or sand along the banks of a river or at the beach). Water also can be observed in the air as clouds, steam or fog, but this comment should be limited to observation only at this grade level (see **Note**).

Investigations (inside or outside) and experimentation must be used to demonstrate the changing properties of water. Use appropriate tools to test and measure water's weight, texture, temperature or size (e.g., compare measurements of water before and after freezing, examine the texture of snow or ice crystals using a hand lens) to document the physical properties.

Future Application of Concepts

Grade 2: Water as a vapor is introduced (water is present in the atmosphere).

Grades 3-5: Water is identified as a non-living resource that can be used for energy, common states of matter include liquids, solids and gases, Earth's surface has been changed by processes involving water and where water is found on Earth.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

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DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Make a mini cold frame that can be used to protect plants from cold temperatures. Use recyclable materials, such as plastic bottles, milk jugs or cartons. Evaluate the placement of the cold frame to get the most autumn/winter sunlight. Compare the results within the class or from class to class. Collect data (temperature, water, outside weather, amount of daily sunlight) to use in the comparison. 	Investigate what happens to water as it freezes and thaws. Collect measurements, take temperature readings and record the length of time to freeze or thaw. Ask: ***What would happen when liquid water gets into rocks or if water boils and then freezes?*** **Note: This investigation can be incorporated into the cold frame design.**	Collect temperature readings during precipitation events. Make a graph, chart or table to compare the temperatures during rainfall, snow or sleet. Discuss the patterns that are observed. 	Identify the different areas where water can be observed (e.g., lakes, stream, ponds, oceans, rain, snow, hail, sleet, fog). Recognize that water can be a solid or a liquid. 
	Investigate the physical differences between snow, crushed ice and/or liquid water (weight, temperature, texture). Ask: ***How much does one cup of snow/crushed ice/liquid water weigh? How does snow/crushed ice look through a hand lens?*** Discuss how these findings can apply to weather observations (e.g., ***how many inches of snow equal one inch of rain?***). 	Differentiate between ocean water and fresh water. 	Recall that heating and freezing water changes it from a solid to a liquid or a liquid to a solid.

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- Some examples of research questions to investigate through inquiry in the classroom or outside include: *How does the amount of water effect how fast water freezes? Why does a lake freeze faster and more completely than the ocean? Does hot water freeze faster or slower than cold water?*
- **The Ohio EPA** has an education site that provides information about wetlands in Ohio. The relationship between water, wetlands and changing seasons is an excellent way to learn about changing properties of water through natural observation.
- **The Primary GLOBE Program** offers teacher-training programs and rich resource materials (including science-based storybooks) for K-4. Environmental stewardship and Earth systems science are emphasized.

COMMON MISCONCEPTIONS

- A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case study *Najwa and Pat–Grade 1* demonstrates engagement of special needs students in scientific inquiry. Strategies are provided to integrate students fully into the science investigations and activities.
- NSTA provides recommended resources to help identify existing misconceptions and help in using inquiry to allow students to uncover and address misconceptions. The resources include methods of using formative assessment effectively for misconceptions about water properties. Find it at **http://learningcenter.nsta.org/search.aspx?action=browse&text=page%20keeley&price=0&product=0&subject=42&topic=452&gradelevel=0&sort=Relevancy**.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case studies *Patricia–Grade 1* and *Ingrid–Grade 1* are examples of how to develop student-led activities and investigations in science. Students' taking charge and being involved in their learning is essential in teaching science through inquiry.

The Annenberg Foundation offers training modules that support Earth and Space Sciences for K-4 teachers. There are numerous resources and video clips of actual classroom practices that can be useful training tools at **http://www.learner.org/resources/series195.html**.

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MODEL CURRICULUM GRADE 1

LIFE SCIENCE (LS)

Topic: Basic Needs of Living Things

This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.

CONTENT STATEMENT

Living things have basic needs, which are met by obtaining materials from the physical environment.

Living things require energy, water and a particular range of temperatures in their environments.

Plants get energy from sunlight. Animals get energy from plants and other animals.

Living things acquire resources from the living and nonliving components of the environment.

CONTENT ELABORATION

Prior Concepts Related to Interactions within Habitats

PreK-K: Use macroscopic ways to identify living things. Living things have physical traits, which enable them to live in different environments.

Grade 1 Concepts

Earth has many different environmental conditions that support living things. The emphasis of this content statement is that living things meet their basic needs for survival by obtaining necessary materials from the environment. This includes, but is not limited to, temperature range, amount of water, amount of sunlight and available food sources. The environment includes both living (plants and animals) and nonliving (e.g., water, air, sunlight, nutrients) things.

Living things get the energy they require to respond, grow and reproduce from the environment. Observing energy being used in everyday situations can help promote understanding that living things get resources from the physical environment. **A detailed discussion of energy is not appropriate at this grade level** (see section heading E). Energy is not scientifically explained until grade 3.

When studying living things, ethical treatment of animals and safety must be employed. Respect for and proper treatment of living things must be modeled. For example, shaking a container, rapping on insect bottles, unclean cages or aquariums, leaving living things in the hot sun or exposure to extreme temperatures (hot or cold) must be avoided. The National Science Teachers Association (NSTA) has a position paper to provide guidance in the ethical use and treatment of animals in the classroom at **http://www.nsta.org/about/positions/animals.aspx**.

Investigations about the types of living things that live in specific environments can be done virtually or in nature.

Future Application of Concepts

Grade 2: How living things impact the environment and how the environment impacts living things will be examined.

Grade 3-5: Life cycles of plants and animals will be explored.

Grades 6-8: Changes in environmental conditions can affect how beneficial a trait will be for survival and reproductive success of an individual or an entire species.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Using data from the Demonstrating Science Knowledge Investigation, design a bird feeder and blend of birdseed that will attract the most birds of one kind or the greatest variety of birds. Share designs, results and recommendations with an authentic audience.	Plan and implement a classroom investigation that answers the question: *Does the type of food influence what type of birds will come to a bird feeder?* **Note: For a simple pinecone bird feeder, cover pinecones with vegetable shortening and coat with one type of food (e.g., black or striped sunflower seeds, millet, cracked corn, thistle).**	Based on observations of birds in the field, compare the food choices of birds in the study and create a chart to communicate findings.	Identify the basic survival needs of plants and animals (classroom pets, plants used in classroom experiments). At this grade level, students will not be assessed on common or scientific names of living things.

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INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- **The Toledo Zoo** offers distance learning Life Science opportunities for animal adaptations. Children can begin to explore how animal traits play a role in survival.
- The Annenberg Media series *Essential Science for Teachers:* **Life Science: Session 1**: What is Life provides background information about the basic needs of living things and provides classroom strategies for instruction.
- Observe a variety of living things in the wild or the classroom and ask questions about how they survive. *How do they get food? Where do they live? What do they use for shelter?* The **Ohio Department of Natural Resources** website also provides information about observing animals in the wild and promotes safety for children and wildlife. The **Guide to Using Animals in the Classroom** explains legally which organisms may be collected.
- Explore various plant life in the local environment. Document the conditions that support the plant. Ask: *Is the area moist? Is it dry? Does it get lots of sun or shade? What other types of plants are in the area?* The physical characteristics and habitat requirements for native trees in Ohio can be found on the **Ohio State Extension** website.
- ODNR-Division of Wildlife's **A to Z Species Guide** has photos, information, tracks and sounds of Ohio's wild animals
- *Project Wild* was developed through a joint effort of the Western Association of Fish and Wildlife Agencies and the Council for Environmental Education. This program helps students learn basic concepts about wild animals, their needs and importance and their relationships to people and the environment. The activity guides are available to educators free of charge when they attend a workshop. Information about upcoming workshops are available on the **ODNR Website**. In the activity *Surprise Terrarium*, students use a classroom terrarium to observe animal behavior and interactions. In *Beautiful Basics*, students list and organize needs of people, pets and wildlife.

Career Connection

Students will design a zoo map that incorporates the climate and environmental characteristics of native habitats for each zoo animal. Lead a discussion to assist students by asking them probing questions such as, *What would a zoologist think about your design? Would an architect agree with your design?*. Identify careers that play a role in the process, such as:

- Zoologist: studying and understanding animals and their behavior.
- Animal Care Worker: managing animals, knowing animal dietary needs, understanding animal behavior.
- Veterinarian: managing the health and wellness of all animals, prescribing and administering medications, and performing surgeries as needed.
- Zoo Maintenance Workers: maintaining the zoo grounds.
- Botanist: work with plants.
- Landscape Architect or Designer: designing animal habitats that are reflective of the animal's natural environment with plants and materials found in different biomes.

COMMON MISCONCEPTIONS

- **Benchmarks for Science Literacy** contains a detailed discussion of energy. Scroll to section heading E for detailed information of grade-appropriate exposure to energy.
- Students may think that food must come from outside an organism. They may also think that fertilizers are actually plant food. They fail to understand that plants make sugars and starches through the process of photosynthesis and that light is essential for plant survival. **Beyond Penguins and Polar Bears** is an online magazine for K-5 teachers that provides information for misconceptions about plants.
- The **Annenberg Media series Essential Science for Teachers** can be used to provide greater insight to misconceptions children hold about living things and energy. Classroom videos and lessons are provided to help students avoid these misconceptions.
- The Annenberg Media series, *Essential Science for Teachers*, offers **Life Science: Sessions 1 and 2**, which provide greater insight to misconceptions children hold about living, dead and nonliving things and strategies to address those misconceptions.
- **AAAS' Benchmarks 2061 Online, Chapter 15**, 5e, *Flow of Matter and Energy*, highlights that children think plants get their food from the environment rather than making it internally from water and air. Students often have difficulty in identifying the source of energy for plants and animals.

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DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

- Many ***Project Wild*** activities feature Universal Design for Learning principals by providing multiple means of concept representation; means of physically interacting with materials; and multiple means of engagement, including collaboration and communication. In ***Surprise Terrarium*** students use a classroom terrarium to observe animal behavior and interactions. Information about upcoming ***Project Wild*** workshops is available on the **ODNR Website**.

CLASSROOM PORTALS

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A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case study ***Jeanie–K*** is an example of how to teach young children about observations of the living environment.

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MODEL CURRICULUM GRADE 1

LIFE SCIENCE (LS)

Topic: Basic Needs of Living Things

This topic focuses on the physical needs of living things in Ohio. Energy from the sun or food, nutrients, water, shelter and air are some of the physical needs of living things.

CONTENT STATEMENT

Living things survive only in environments that meet their needs.

Resources are necessary to meet the needs of an individual and populations of individuals. Living things interact with their physical environments as they meet those needs.

Effects of seasonal changes within the local environment directly impact the availability of resources.

CONTENT ELABORATION

Prior Concepts Related to Interactions within Habitats

PreK-K: Use macroscopic ways to identify living things. Living things have physical traits, which enable them to live in different environments.

Grade 1 Concepts

Plants and animals require resources from the environment. The focus at this grade level is on macroscopic interactions and needs of common living things (plants and animals).

Animals require basic habitat components, including food, water, cover and space. The amount and distribution of the basic components will influence the types of animals that can survive in an area. Food sources might include insects, plants, seeds or other animals. Water sources may be as small as drops of dew found on grass or as large as a lake or river. Animals need cover for many life functions, including nesting, escaping from predators, seeking shelter from the elements on a cold winter day and resting. Animals also need space in which to perform necessary activities such as feeding or raising young. Seasonal changes affect the resources available to living things (e.g., grasses are not as available in winter as they are in summer).

The needs of plants include room to grow, temperature range, light, water, air, nutrients and time (growing season). The amount and distribution of these will influence the types of plants that can survive in an area. Observations of seasonal changes in temperature, liquid water availability, wind and light must be applied to the effect of seasonal changes on local plants.

Future Application of Concepts

Grade 2: This concept expands to include interactions between organisms and the physical environment in which the organisms or the physical environment are changed.

Grade 3-5: The fact that organisms have life cycles that are part of their adaptations for survival in their natural environment builds upon this concept.

Grades 6-8: In any particular biome, the number, growth and survival of organisms and populations depend on biotic and abiotic factors.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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Using data from the Demonstrating Science Knowledge investigation, design a bird feeder and blend of birdseed that will attract the most birds of one kind or the greatest variety of birds. Share designs, results and recommendations with an authentic audience.	Plan and implement a classroom investigation that answers the question: *Does the type of food influence what type of birds will come to a bird feeder?* **Note: For a simple pinecone bird feeder, cover pinecones with vegetable shortening and coat with one type of food (e.g., black or striped sunflower seeds, millet, cracked corn, thistle).**	Explain, draw, journal and photograph what happens to local living and nonliving environments over the course of a school year. If resources are not available to draw or photograph, seasonal photographs taken in Ohio can be found on the Ohio Department of Natural Resources **website**.	Match pictures of local plants and animals to the environment in which they can be found. Photographs of Ohio plants and animals can be found on the Ohio Department of Natural Resources **website**.
	Plan and implement a classroom investigation to monitor a specific plant or animal over a long period (a semester or the school year). Observe and record the behavioral and physical changes that occur in that animal or plant.		

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INSTRUCTIONAL STRATEGIES AND RESOURCES

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- **The Great Backyard Bird Count** is an opportunity to make observations, and collect and report data in a local environment to create a real-time snapshot of bird locations. Note the environmental conditions in the area when birds are spotted and when they migrate. Ask: ***What do these environmental changes mean for the birds?***
- **Cornell Lab of Ornithology** sponsors a site to collect data for birds in the local environment by watching bird feeders to create a real-time snapshot of bird populations.
- **Wildlife Watch** is sponsored by the National Wildlife Federation. Students can identify and track plants and animals that are found locally and nationally. Information about the number of individuals spotted, pictures and personal stories can be recorded and shared on this site. Data can be used to determine what areas support what types of organisms and where organisms are thriving and barely surviving.
- **Near One Cattail: Turtles, Logs and Leaping Frogs** by Anthony D. Fredericks is a book resource recommended by the Ohio Resource Center and Americans for the Advancement of Science. The book can be used in conjunction with a host of activities for a nature study.
- *Project Wild* was developed through a joint effort of the Western Association of Fish and Wildlife Agencies and the Council for Environmental Education. This program helps students learn basic concepts about wild animals, their needs and importance and their relationships to people and the environment. The activity guides are available to educators free of charge when they attend a workshop. Information about upcoming workshops are available on the **ODNR Website**. If explicit connections between environment and organism survival are made, the following *Project Wild* activities could be helpful: in *Wildlife is Everywhere*, children make observations and understand that wildlife is all around us; in *Field Study Fun*, children investigate a field study plot to observe plant and animal interactions over time; in *Urban Nature Search* students make observations of habitats that are found around their schoolyard and can be done seasonally to illustrate changes; and in *Surprise Terrarium* students use a classroom terrarium to observe animal behavior and interactions.

COMMON MISCONCEPTIONS

- The Annenberg Media series **Essential Science for Teachers** can be used to provide greater insight to misconceptions children hold about living things and energy. Classroom videos and lessons are provided to help students avoid these misconceptions.
- **Benchmarks for Science Literacy** contains a detailed discussion of energy. Scroll to section heading E for detailed information of grade-appropriate exposure to energy.
- The Annenberg Media series, *Essential Science for Teachers,* offers **Life Science: Session 2**, which provides greater insight to misconceptions children hold about classifying living things and strategies to address those misconceptions.
- **AAAS' Benchmarks 2061 Online, Chapter 15**, *Interdependence of Life*, highlights that students understand simple food links between organisms but they think of organisms as independent of each other but dependent on people to supply them with food and shelter.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

- Perkins School for the Blind, Watertown, MA, offers webcast videos including the video chapter *Accessible Science – Life Science*, which encourages the use of terrariums with visually handicapped students instead of aquariums. Find it at **http://support.perkins.org/site/PageServer?pagename=Webcasts_Acessible_Science_Life_Science**.
- Many *Project Wild* activities feature Universal Design for Learning principals by providing multiple means of concept representation; means of physically interacting with materials; and multiple means of engagement, including collaboration and communication. In *Surprise Terrarium*, students use a classroom terrarium to observe animal behavior and interactions. In *Wildlife is Everywhere*, children make observations and understand that wildlife is all around us. In *Field Study Fun*, children investigate a field study plot to observe plant and animal interactions over time. In *Urban Nature Search* students make observations of habitats that are found around their schoolyard and can be done seasonally to illustrate changes. Information about upcoming *Project Wild* workshops is available on the **ODNR Website**.

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CLASSROOM PORTALS

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A series of case studies of K-8 science classrooms by the Smithsonian and Harvard University can be found at **http://www.learner.org/resources/series21.html**. Teachers need to sign up to use this free site. The case study ***Najwa and Pat–Grade 1*** is an example of how to teach young children about the requirement of living things.

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MODEL CURRICULUM GRADE 1

PHYSICAL SCIENCE (PS)

Topic: Motion and Materials

This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.

CONTENT STATEMENT

Properties of objects and materials can change.

Objects and materials change when exposed to various conditions, such as heating or freezing. Not all materials change in the same way.

Note 1: Changes in temperature are a result of changes in energy.

Note 2: Water changing from liquid to solid and from solid to liquid is found in ESS grade 1.

CONTENT ELABORATION

Prior Concepts Related to Properties of Objects and Materials

PreK-K: Objects are things that can be seen or felt. Properties can be observed using tools or one's senses and can be used to sort objects. Comparisons of objects are made as a precursor to measurement.

Grade 1 Concepts:

Materials can be exposed to conditions that change some of their properties, but not all materials respond the same way. The properties of a material can change as it interacts with other materials. Heating and cooling changes some, but not all, properties of materials.

Some materials can be a liquid or solid at room temperature and may change from one form to the other with a change in the temperature. A liquid may turn into a solid when frozen. A solid may turn into a liquid when heated. The amount of the material in the solid or liquid remains the same. Investigations and experiments (may include virtual investigations) must be conducted to explore property changes of objects and materials.

Parts of objects have specific properties that allow them to work with other parts to carry out a particular function. Something may not work well or at all if a part of it is missing, broken, worn out, mismatched or misconnected. Toys that can be assembled from several parts can be investigated when one or more of the parts are missing.

Note: Emphasis is placed on observations. Concepts of thermal energy, atoms and heat transfer are inappropriate at this grade.

Future Application of Concepts

Grade 2: Water can change from liquid to vapor in the air and from vapor to liquid (ESS).

Grades 3-5: Matter is defined. Measurements of weight and liquid volume are made. Properties of solids, liquids and gases, and phase changes are explored. During any change, including phase changes, the total mass* remains constant. The sum of the mass* of the parts of an object is equal to the mass* of the entire object.

*While mass is the scientifically correct term to use in this context, the **NAEP 2009 Science Framework** (page 27) recommends using the more familiar term "weight" in the elementary grades with the distinction between mass and weight being introduced at the middle school level. In Ohio, students will not be assessed on the differences between mass and weight until Grade 6.

EXPECTATIONS FOR LEARNING: COGNITIVE DEMANDS

This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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VISIONS INTO PRACTICE: CLASSROOM EXAMPLES

This section provides examples of tasks that students may perform; this includes guidance for developing classroom performance tasks. It is not an all-inclusive checklist of what should be done, but is a springboard for generating innovative ideas.

DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Investigate the multiple ways properties of objects and materials change.			
Using the findings (about shapes) from the Demonstrating Science Knowledge section, design and build a small boat out of recycled materials and can float in water for a specific period of time.	Plan and implement an investigation to test various clay shapes (e.g., a clay ball, a clay block, flattened clay with edges) to determine how shape affects the ability of a material to float or sink in water.	Compare different ways of changing an object or material (e.g., tearing, heating, cooling, mixing, taking apart, putting together).	Recognize and classify various types of changes that objects or materials can go through to change observable properties (e.g., freezing, melting, tearing, wetting).

INSTRUCTIONAL STRATEGIES AND RESOURCES

This section provides additional support and information for educators. These are strategies for actively engaging students with the topic and for providing hands-on, minds-on observation and exploration of the topic, including authentic data resources for scientific inquiry, experimentation and problem-based tasks that incorporate technology and technological and engineering design. Resources selected are printed or Web-based materials that directly relate to the particular Content Statement. It is not intended to be a prescriptive list of lessons.

- **Kitchen Magician** is a game from PBS Kids that emphasizes how materials can change during cooking.

COMMON MISCONCEPTIONS

- Although two materials are required for the dissolving process, children tend to focus only on the solid and they regard the process as melting. (Driver, Squires, Rushworth & Wood-Robinson, 1994, p.80)
- **Heat is a substance.**
- Cold is the opposite of heat and is another substance.
- **Melting/freezing** and boiling/condensation are often understood only in terms of water.
- **When things** dissolve, they disappear.
- Melting and dissolving are confused.
- Cold can be transferred.

DIVERSE LEARNERS

Strategies for meeting the needs of all learners including gifted students, English Language Learners (ELL) and students with disabilities can be found at **this site**. Resources based on the Universal Design for Learning principles are available at **www.cast.org**.

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CLASSROOM PORTALS

These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

From a time of about 11:40, this video on demand produced by Annenberg shows how a teacher can lead children to make **observations about changes in snow** under different conditions. While content shown during other segments of the video does not apply to this content statement, watching the entire sequence demonstrates how Jennie learns to incorporate inquiry-based science activities into her lessons. These instructional strategies can be applied to any content area.

Starting at a time of about 17:50 on this video on demand produced by Annenberg, children **explore changes of matter** by mixing different colors of liquid drops. Allowing students to do their own experiments increases enthusiasm for science and encourages creativity. Later they mix colors using different colors of transparent cellophane. While content shown during other segments of the video does not apply to this content statement, watching the entire sequence demonstrates how Elsa learns to incorporate appropriate science experiences with lessons that teach social, motor and communication skills in her bilingual classroom. These instructional strategies can be applied to any content area.

In this beginning of this video on demand produced by Annenberg, Ingrid explores what students already know about **phases of matter** through a class discussion and journal writing. She then has students investigate the properties of phases and leads a class discussion to come to a consensus about what is important to know about solids, liquids and gases. While content shown during other segments of the video does not apply to this content statement, watching the entire sequence demonstrates how Ingrid, a beginning first-grade teacher, is working on incorporating student ideas into her lessons. Initially, she struggles with what to do with incorrect ideas. She ends up writing all ideas down and has students test the ideas and evaluate each idea based on evidence. While not all of the content is applicable to this content statement, the instructional strategies demonstrated can be applied to any content area.

Patricia, a first-grade teacher, explores the benefits and challenges of having children **work in small groups**, as opposed to a single classroom group, in this video on demand produced by Annenberg. She guides students to better social skills and learns to become more comfortable with less structure. While not all of the content is applicable to this content statement, the instructional strategies demonstrated can be applied to any content area.

Another video on demand produced by Annenberg features Najwa and Pat, first-grade teachers who are working to develop their students' science skills of **prediction and observation**. While not all of the content is applicable to this content statement, the instructional strategies demonstrated can be applied to any content area.

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MODEL CURRICULUM GRADE 1

PHYSICAL SCIENCE (PS)

Topic: Motion and Materials

This topic focuses on the changes in properties that occur in objects and materials. Changes of position of an object are a result of pushing or pulling.

CONTENT STATEMENT

Objects can be moved in a variety of ways, such as straight, zigzag, circular and back and forth.

The position of an object can be described by locating it relative to another object or to the object's surroundings.

An object is in motion when its position is changing.

The motion of an object can be affected by pushing or pulling. A push or pull is a force that can make an object move faster, slower or go in a different direction.

Note: Changes in motion are a result of changes in energy.

CONTENT ELABORATION

Prior Concepts Related to Motion

PreK-K: Vibrating objects can cause sound.

Grade 1 Concepts:

The position of an object is described by comparing its location relative to another object (e.g., in front, behind, above, below). Objects can be moved and their positions are changed.

Objects can move in a straight line (like a dropped coin falling to the ground) or a circle (like a pinwheel) or back and forth (like a swing) or even in a zigzag pattern. Objects near Earth fall to the ground unless something holds them up.

Object motion can be faster, slower or change direction by pushing or pulling the object. Experimentation, testing and investigations of different ways to change the motion of different objects (such as a ball, a pinwheel or a kite) must be used to demonstrate movement.

Note 1: Scientific definitions and calculations of speed are inappropriate at this grade.

Note 2: Force is a push or pull between two objects and energy is the property of an object that can cause change. A force acting on an object can sometimes result in a change in energy. The differences between force and energy will be developed over time and are not appropriate for this grade.

Future Application of Concepts

Grade 2: Forces are necessary to change the motion of objects.

Grades 3-5: The amount of change in movement of an object is based on the mass* of the object and the amount of force exerted.

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This section provides definitions for Ohio's science cognitive demands, which are intrinsically related to current understandings and research about how people learn. They provide a structure for teachers and assessment developers to reflect on plans for teaching science, to monitor observable evidence of student learning, and to develop summative assessment of student learning of science.

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DESIGNING TECHNOLOGICAL/ ENGINEERING SOLUTIONS USING SCIENCE CONCEPTS	DEMONSTRATING SCIENCE KNOWLEDGE	INTERPRETING AND COMMUNICATING SCIENCE CONCEPTS	RECALLING ACCURATE SCIENCE
Investigate ways to make a ping-pong ball move in a zigzag pattern.			
Design, construct and test a device that will cause a ping-pong ball to move in a zigzag pattern. Test and evaluate the effectiveness of the different devices made by different groups in the class. Redesign the device for greater effectiveness. 		Compare the designs and their effectiveness from different devices made by different groups in the class. 	Recognize that to speed up, slow down or change the movement direction of an object, a push or pull is needed.
Investigate ways to change the motion of an object.			
	Implement a scientific investigation to determine: ***How can a ball be made to speed up (slow down or change direction)?*** With the class, list all the ways that were found. 	Orally present the results of the experiments to the class.  Make a written list of all the observations from the class. Compare the different methods used by different groups in the class. Represent the different motions of a toy in words, pictures and diagrams.	Recognize that to speed up, slow down or change the movement direction of an object, a push or pull is needed. Identify an object's position with respect to another object or the background.

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- **Making Objects Move** provides a strategy that emphasizes an inquiry approach to teaching and learning about different motions of objects. It includes many questions for possible investigations that children can perform. The second part has an idea for a design project.
- *Force and Motion*, produced by Annenberg, is a series of videos designed for teachers to improve their knowledge of forces and motion and gives ideas for teaching the concepts to elementary learners. This particular segment demonstrates experiences with balls and inclined planes that can get first-grade children to **observe movement** and to make inferences about forces that start the balls moving.
- Have children choose a movement and race to the other side of classroom/gym.

COMMON MISCONCEPTIONS

- **The location** of an object can be described by stating its distance from a given point, ignoring direction.
- The only natural motion is for an object to be at rest.
- If an object is at rest, no forces are acting on the object.

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These are windows into the classroom through webcasts, podcasts or video clips to exemplify and model classroom methods of teaching science using inquiry.

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Force and Motion is a series of videos produced by Annenberg that is designed for teachers to improve their knowledge of forces and motion and gives ideas for teaching the concepts to elementary learners. This particular lesson shows how first-grade students can use balls in different ways to **explore different types of motion**.

Patricia, a first-grade teacher, explores the benefits and challenges of having children **work in small groups**, as opposed to a single classroom group, in this video on demand produced by Annenberg. She guides students to better social skills and learns to become more comfortable with less structure. While not all of the content is applicable to this content statement, the instructional strategies demonstrated can be applied to any content area.

Another video on demand produced by Annenberg features Najwa and Pat, first-grade teachers who are working to develop children's science skills of **prediction and observation**. While not all of the content is applicable to this content statement, the instructional strategies demonstrated can be applied to any content area.